

IN THE CLAIMS:

1. (Original) An ink jet printer head, comprising:

a cavity unit having a plurality of nozzles arranged in a reference direction, a plurality of pressure chambers which communicate with the nozzles, respectively, and a plurality of partition walls which separate the pressure chambers from each other;

a piezoelectric actuator having a plurality of active portions each of which is driven to change a pressure of an ink accommodated in a corresponding one of the pressure chambers, and thereby eject, from a corresponding one of the nozzles, a droplet of the ink, the cavity unit and the piezoelectric actuator being fixed to each other;

the piezoelectric actuator comprising a plurality of sheet members which are stacked on each other and include at least one piezoelectric sheet; at least one common electrode; and at least one individual-electrode layer including a plurality of individual electrodes which are aligned with the pressure chambers, respectively, and each of which cooperates with a corresponding one of a plurality of portions of said at least one common electrode to sandwich a corresponding one of a plurality of portions of said at least one piezoelectric sheet, in a direction of stacking of the sheet members, and thereby provide a corresponding one of the active portions of the piezoelectric actuator;

the piezoelectric actuator further comprising a plurality of external pads which are provided on an outer surface of an outermost sheet member of the sheet members and are electrically connected to a cable member through which drive signals for said active portions are transmitted; and a plurality of internal leads which electrically connect between the individual electrodes and the external pads, respectively; and

the external pads being located, on the outer surface of the outermost sheet member of the piezoelectric actuator, at respective positions that are at least partially aligned with the partition walls each of which is located between corresponding two pressure chambers of the plurality of pressure chambers in said reference direction.

2. (Original) The printer head according to claim 1, wherein the internal leads of the piezoelectric actuator are formed in respective through-holes formed through a thickness of the outermost sheet member.

3. (Original) The printer head according to claim 1, wherein a length of each of the external pads is smaller than a length of each of the partition walls.

4. (Original) The printer head according to claim 1, wherein the piezoelectric actuator further comprises a plurality of electrical conductors which are formed on the outer surface of the outermost sheet member of the piezoelectric actuator, and wherein the external pads are formed on the electrical conductors, respectively.

5. (Original) The printer head according to claim 4, wherein the electrical conductors are formed, by printing and firing, on the outer surface of the outermost sheet member of the piezoelectric actuator, and wherein the external pads are subsequently formed, by printing, on the electrical conductors, respectively.

6. (Original) The printer head according to claim 4, wherein the internal leads extend through a thickness of the outermost sheet member of the piezoelectric actuator, wherein the electrical conductors are electrically connected to the individual electrodes via the internal leads, respectively, and extend parallel to the pressure chambers, respectively, in a direction perpendicular to the reference direction, and wherein the external pads are formed on the outer surface of the outermost sheet member of the piezoelectric actuator, such that each of the external pads partly overlaps a corresponding one of the electrical conductors.

7. (Original) The printer head according to claim 1, wherein each of the individual electrodes which are aligned with the pressure chambers, respectively, includes an end portion which is electrically connected to a corresponding one of the internal leads, is inclined relative to a remaining portion of said each individual electrode, and is extended to a position which is offset outward from a corresponding one of the pressure chambers in a direction perpendicular to the reference direction and which is aligned with a corresponding one of the external pads in the direction of stacking of the sheet members.

8. (Original) The printer head according to claim 7, wherein the remaining portion of said each individual electrode comprises a straight portion which is connected to the end portion

thereof and which extends parallel to said one pressure chamber in said direction perpendicular to the reference direction and is aligned with said one pressure chamber.

9. (Original) The printer head according to claim 1, wherein the nozzles of the cavity unit are arranged in four arrays, and wherein the active portions of the piezoelectric actuator are arranged in four arrays respectively corresponding to the four arrays in which the nozzles are arranged.

10. (Original) An ink jet printer head, comprising:

a cavity unit having a plurality of nozzles arranged in a reference direction, and a plurality of pressure chambers which communicate with the nozzles, respectively, and which are grouped into at least two groups of pressure chambers each group of which consists of at least two pressure chambers arranged in the reference direction;

a piezoelectric actuator having a plurality of active portions each of which is driven to change a pressure of an ink accommodated in a corresponding one of the pressure chambers, and thereby eject, from a corresponding one of the nozzles, a droplet of the ink, the cavity unit and the piezoelectric actuator being fixed to each other;

the piezoelectric actuator comprising at least two actuator portions each of which has a plurality of active portions and which are arranged next to each other in the reference direction such that respective one ends of said at least two actuator portions are opposed to each other in the reference direction, and such that said at least two actuator portions are opposed to said at least two groups of pressure chambers, respectively;

said each of said at least two actuator portions comprising a plurality of sheet members which are stacked on each other and include at least one piezoelectric sheet; at least one common electrode; and at least one individual-electrode layer including a plurality of individual electrodes which are aligned with said at least two pressure chambers of a corresponding one of said at least two groups of pressure chambers, respectively, and each of which cooperates with a corresponding one of a plurality of portions of said at least one common electrode to sandwich a corresponding one of a plurality of portions of said at least one piezoelectric sheet, in a direction of stacking of the sheet members, and thereby provide a corresponding one of the active portions of said each actuator portion;

said each of said at least two actuator portions further comprising a plurality of external pads which are provided on an outer surface of an outermost sheet member of the sheet members, such that the external pads are arranged in the reference direction, and are electrically connected to a flat cable; and a plurality of internal leads which electrically connect between the individual electrodes and the external pads, respectively; and one of the external pads of said each actuator portion that is nearest to said one end of said each actuator portion in the reference direction being more distant from said one end than one of the active portions of said each actuator portion that is nearest to said one end.

11. (Original) The printer head according to claim 10, wherein the external pads of said each actuator portion are arranged in at least one array at a predetermined regular interval of distance in the reference direction.

12. (Original) The printer head according to claim 10, wherein the internal leads of said each actuator portion are formed in respective through-holes formed through a thickness of the outermost sheet member of said each actuator portion.

13. (Original) The printer head according to claim 10, wherein said each actuator portion further comprises a plurality of electrical conductors which are formed on the outer surface of the outermost sheet member of said each actuator portion, and wherein the external pads of said each actuator portion are formed on the electrical conductors, respectively.

14. (Original) The printer head according to claim 13, wherein the electrical conductors are formed, by printing and firing, on the outer surface of the outermost sheet member of said each actuator portion, and wherein the external pads of said each actuator portion are subsequently formed, by printing, on the electrical conductors, respectively.

15. (Original) The printer head according to claim 10, wherein the nozzles of the cavity unit are arranged in four arrays, and wherein the active portions of said each actuator portion are arranged in four arrays respectively corresponding to the four arrays in which the nozzles are arranged.

16. (Original) An ink jet printer head, comprising:

a cavity unit having a plurality of nozzles arranged in a first direction, and a plurality of pressure chambers which communicate with the nozzles, respectively;

a piezoelectric actuator having a plurality of active portions each of which is driven to change a pressure of an ink accommodated in a corresponding one of the pressure chambers, and thereby eject, from a corresponding one of the nozzles, a droplet of the ink, the cavity unit and the piezoelectric actuator being fixed to each other;

the piezoelectric actuator comprising a plurality of sheet members which are stacked on each other and include at least one piezoelectric sheet; at least one common electrode; and at least one individual-electrode layer including a plurality of individual electrodes which are aligned with the pressure chambers, respectively, and each of which cooperates with a corresponding one of a plurality of portions of said at least one common electrode to sandwich a corresponding one of a plurality of portions of said at least one piezoelectric sheet, in a direction of stacking of the sheet members, and thereby provide a corresponding one of the active portions of the piezoelectric actuator;

said at least one common electrode being provided on one of opposite planar surfaces of said at least one piezoelectric sheet, such that said at least one common electrode is elongate in the first direction and has a first edge line parallel to the first direction; and

the piezoelectric actuator further comprising a plurality of first internal leads which extend through a thickness of said at least one piezoelectric sheet; and a plurality of first internal pads which are electrically connected to the individual electrodes via the first internal leads, respectively, and which are provided on said one planar surface of said at least one piezoelectric sheet, such that each of the first internal pads is distant from the first edge line of said at least one common electrode by a first predetermined distance in a second direction perpendicular to the first direction, and extends in a third direction inclined by a first predetermined angle relative to the second direction.

17. (Original) The ink jet printer head according to claim 16, wherein said at least one common electrode includes a plurality of first electrically conductive portions each of which at least partly overlaps a corresponding one of the pressure chambers and is elongate in the second direction, and additionally including at least one second electrically conductive

portion which extends in the first direction to connect respective one ends of the first conductive portions.

18. (Original) The ink jet printer head according to claim 16, wherein the sheet members further comprises an outer sheet member which is stacked on said at least one piezoelectric sheet, and wherein the piezoelectric actuator further comprises a common electrical conductor which has a shape substantially identical with a shape of said at least one common electrode, is electrically connected to said at least one common electrode, and is provided on one of opposite planar surfaces of the outer sheet member, such that the common electrical conductor is elongate in the first direction and has a second edge line parallel to the first direction; and a plurality of second internal leads which extend through a thickness of the outer sheet member; and a plurality of second internal pads which are electrically connected to the first internal pads via the second internal leads, respectively, and which are provided on said one planar surface of the outer sheet member, such that each of the second internal pads is distant from the second edge line of the common electrical conductor by a second predetermined distance in the second direction, and extends in a fourth direction inclined by a second predetermined angle relative to the second direction.

19. (Original) The ink jet printer head according to claim 18, wherein each of the first and second predetermined angles is an acute angle relative to the second direction, and wherein the third and fourth directions are parallel to each other.

20. (Original) The ink jet printer head according to claim 18, wherein each of the first and second internal pads has an elliptical shape.

21. (Original) The ink jet printer head according to claim 18, further comprises at least one third internal lead which extends through a thickness of the outer sheet member and which electrically connects between the common electrical conductor and said at least one common electrode.

22. (Original) The ink jet printer head according to claim 18, wherein the first internal pads are distant from each other by the first predetermined distance in the first direction, and the second internal pads are distant from each other by the second predetermined distance in the first direction.

23. (Original) The ink jet printer head according to claim 18, wherein the nozzles of the cavity unit are arranged in a plurality of arrays which are distant from each other by a third predetermined distance in the second direction, and the pressure chambers are arranged in a plurality of arrays which are distant from each other by a fourth predetermined distance in the second direction, wherein said at least one common electrode has two said first edge lines which extend in the first direction and are distant from each other in the second direction, and the first internal pads are provided in an area between the two first edge lines, and wherein the common electrical conductor has two said second edge lines which extend in the first direction and are distant from each other in the second direction, and the second internal pads are provided in an area between the two second edge lines.

24. (Original) The ink jet printer head according to claim 16, wherein the nozzles of the cavity unit are arranged in four arrays, and wherein the active portions of the piezoelectric actuator are arranged in four arrays respectively corresponding to the four arrays in which the nozzles are arranged.

25. (Currently Amended) An ink jet printer head, comprising:

- a cavity unit having a plurality of nozzles arranged in a first direction, and a plurality of pressure chambers which communicate with the nozzles, respectively, and each of which is elongate in a second direction perpendicular to the first direction;

- a piezoelectric actuator having a plurality of active portions each of which is driven to change a pressure of an ink accommodated in a corresponding one of the pressure chambers, and thereby eject, from a corresponding one of the nozzles, a droplet of the ink, the cavity unit and the piezoelectric actuator being fixed to each other;

- the piezoelectric actuator comprising a plurality of sheet members which are stacked on each other and include at least one piezoelectric sheet; at least one common electrode; and at least one individual-electrode layer including a plurality of individual electrodes which are aligned with the pressure chambers, respectively, and each of which

cooperates with a corresponding one of a plurality of portions of said at least one common electrode to sandwich a corresponding one of a plurality of portions of said at least one piezoelectric sheet, in a direction of stacking of the sheet members, and thereby provide a corresponding one of the active portions of the piezoelectric actuator;

said at least one common electrode including (a) a plurality of first electrically conductive portions each of which at least partly overlaps a corresponding one of the pressure chambers, and is elongate in the second direction, (b) a plurality of non-conductive areas each of which is not electrically conductive and which are alternate with the first conductive portions in the first direction, and ~~additionally including~~ (c) at least one second electrically conductive portion which extends in the first direction to connect respective one ends of the first conductive portions to each other.

26. (Original) The printer head according to claim 25, wherein said at least one common electrode includes two said electrically conductive portions one of which extends in the first direction to connect the respective one ends of the first conductive portions and the other of which extends in the first direction to connect the respective other ends of the first conductive portions

27. (Original) The printer head according to claim 25, wherein said at least one common electrode is provided on one of opposite planar surfaces of said at least one piezoelectric sheet, such that said at least one common electrode is elongate in the first direction and has a first edge line parallel to the first direction, and wherein the piezoelectric actuator further comprises a plurality of first internal leads which extend through a thickness of said at least one piezoelectric sheet; and a plurality of first internal pads which are electrically connected to the individual electrodes via the first internal leads, respectively, and are provided on said one planar surface of said at least one piezoelectric sheet, such that each of the first internal pads is distant from the first edge line of said at least one common electrode by a first predetermined distance in the second direction.

28. (Original) The ink jet printer head according to claim 27, wherein the sheet members further comprises an outer sheet member which is stacked on said at least one piezoelectric sheet, and wherein the piezoelectric actuator further comprises a common electrical conductor which has a shape substantially identical with a shape of said at least one common

electrode, is electrically connected to said at least one common electrode, and is provided on one of opposite planar surfaces of the outer sheet member, such that the common electrical conductor is elongate in the first direction and has a second edge line parallel to the first direction; a plurality of second internal leads which extend through a thickness of the outer sheet member; and a plurality of second internal pads which are electrically connected to the first internal pads via the second internal leads, respectively, and which are provided on said one planar surface of the outer sheet member, such that each of the second internal pads is distant from the second edge line of the common electrical conductor by a second predetermined distance in the second direction.

29. (Original) The ink jet printer head according to claim 28, further comprises at least one third internal lead which extends through a thickness of the outer sheet member and which electrically connects between the common electrical conductor and said at least one common electrode.

30. (Original) The ink jet printer head according to claim 28, wherein the nozzles of the cavity unit are arranged in a plurality of arrays which are distant from each other by a third predetermined distance in the second direction, and the pressure chambers are arranged in a plurality of arrays which are distant from each other by a fourth predetermined distance in the second direction, wherein said at least one common electrode has two said first edge lines which extend in the first direction and are distant from each other in the second direction, and the first internal pads are provided in an area between the two first edge lines, and wherein the common electrical conductor has two said second edge lines which extend in the first direction and are distant from each other in the second direction, and the second internal pads are provided in an area between the two second edge lines.

31. (Original) The ink jet printer head according to claim 25, wherein the nozzles of the cavity unit are arranged in four arrays, and wherein the active portions of the piezoelectric actuator are arranged in four arrays respectively corresponding to the four arrays in which the nozzles are arranged.

32. (Original) An ink jet printer head, comprising:

a cavity unit having a plurality of nozzles arranged in a first direction, a plurality of pressure chambers which communicate with the nozzles, respectively, and a plurality of partition walls which separate the pressure chambers from each other and each of which extends in a second direction perpendicular to the first direction;

a piezoelectric actuator having a plurality of active portions each of which is driven to change a pressure of an ink accommodated in a corresponding one of the pressure chambers, and thereby eject, from a corresponding one of the nozzles, a droplet of the ink, the cavity unit and the piezoelectric actuator being fixed to each other;

the piezoelectric actuator comprising a plurality of sheet members which are stacked on each other and include at least one piezoelectric sheet; at least one common electrode; and at least one individual-electrode layer including a plurality of individual electrodes which are aligned with the pressure chambers, respectively, and each of which cooperates with a corresponding one of a plurality of portions of said at least one common electrode to sandwich a corresponding one of a plurality of portions of said at least one piezoelectric sheet, in a direction of stacking of the sheet members, and thereby provide a corresponding one of the active portions of the piezoelectric actuator;

said at least one common electrode being provided on one of opposite planar surfaces of said at least one piezoelectric sheet, such that said at least one common electrode is elongate in the first direction and has a first edge line parallel to the first direction;

the piezoelectric actuator further comprising a plurality of first internal leads which extend through a thickness of said at least one piezoelectric sheet; and a plurality of internal pads which are electrically connected to the individual electrodes via the first internal leads, respectively, and which are provided on said one planar surface of said at least one piezoelectric sheet, such that each of the internal pads is distant from the first edge line of said at least one common electrode by a first predetermined distance in the second direction, and extends in a third direction inclined by a first predetermined angle relative to the second direction;

the piezoelectric actuator further comprising a plurality of external pads which are provided on an outer surface of an outermost sheet member of the sheet members and are electrically connected to a cable member; and

each of the individual electrodes including an end portion which extends in a fourth direction inclined by a second predetermined angle relative to the second direction, the

end portion of said each individual electrode being connected to a corresponding one of the external pads via a corresponding one of the first internal leads and a corresponding one of the internal pads.

33. (Original) The ink jet printer head according to claim 32, wherein the third and fourth directions are parallel to each other.

34. (Original) The ink jet printer head according to claim 32, wherein the external pads are located, on the outer surface of the outermost sheet member of the piezoelectric actuator, at respective positions that are at least partially aligned with the partition walls each of which is located between corresponding two pressure chambers of the plurality of pressure chambers in said reference direction, wherein the piezoelectric actuator further comprising a plurality of second internal leads which extend through a thickness of the outermost sheet member and electrically connect between the internal pads and the external pads, respectively, and wherein the end portion of said each individual electrode is connected to a corresponding one of the external pads via a corresponding one of the first internal leads, a corresponding one of the internal pads, and a corresponding one of the second internal leads.

35. (Original) The printer head according to claim 32, wherein said each of the individual electrodes includes a straight portion which is connected to the end portion thereof and which extends parallel to a corresponding one of the pressure chambers in the second direction and is aligned with said one pressure chamber.

36. (Currently Amended) An ink jet printer head, comprising:

a cavity unit having a plurality of nozzles arranged in a first direction, and a plurality of pressure chambers which communicate with the nozzles, respectively, and which are grouped into at least two groups of pressure chambers each group of which consists of at least two pressure chambers arranged in the first direction;

a piezoelectric actuator having a plurality of active portions each of which is driven to change a pressure of an ink accommodated in a corresponding one of the pressure chambers, and thereby eject, from a corresponding one of the nozzles, a droplet of the ink, the cavity unit and the piezoelectric actuator being fixed to each other;

the piezoelectric actuator comprising at least two actuator portions each of which has a plurality of active portions and which are arranged next to each other in the first direction such that respective one ends of said at least two actuator portions are opposed to each other in the first direction, and such that said at least two actuator portions are opposed to said at least two groups of pressure chambers, respectively;

said each of said at least two actuator portions comprising a plurality of sheet members which are stacked on each other and include at least one piezoelectric sheet; at least one common electrode; and at least one individual-electrode layer including a plurality of individual electrodes which are aligned with said at least two pressure chambers of a corresponding one of said at least two groups of pressure chambers, respectively, and each of which cooperates with a corresponding one of a plurality of portions of said at least one common electrode to sandwich a corresponding one of a plurality of portions of said at least one piezoelectric sheet, in a direction of stacking of the sheet members, and thereby provide a corresponding one of the active portions of said each actuator portion;

said at least one common electrode being provided on one of opposite planar surfaces of said at least one piezoelectric sheet, such that said at least one common electrode is elongate in the first direction and has a first edge line parallel to the first direction; said each actuator portion further comprising a plurality of internal leads which extend through a thickness of said at least one piezoelectric sheet; and a plurality of internal pads which are electrically connected to the individual electrodes via the internal leads, respectively, and which are provided on said one planar surface of said at least one piezoelectric sheet, such that each of the internal pads is distant from the first edge line of said at least one common electrode by a first predetermined distance in a second direction perpendicular to the first direction, and extends in a third direction inclined by a first predetermined angle relative to the second direction;

said each of said at least two actuator portions further comprising a plurality of external pads which are provided on an outer surface of an outermost sheet member of the sheet members, such that the external pads are arranged in the first direction, and are electrically connected to a flat cable;

each of the individual electrodes of said each actuator portion including an end portion which is inclined in a direction away from said one end of said each actuator portion; and the end portion of said each individual electrode being connected to a corresponding one of the external pads via a corresponding one of the internal pads ~~pads~~ leads and a corresponding one of the internal pads.

37. (Original) The ink jet printer head according to claim 36, wherein the end portion of said each individual electrode extends in a fourth direction inclined by a second predetermined angle relative to the second direction in which the partition walls of the cavity unit extend

38. (Original) The ink jet printer head according to claim 37, wherein the external pads are located, on the outer surface of the outermost sheet member of the piezoelectric actuator, at respective positions that are at least partially aligned with the partition walls each of which is located between corresponding two pressure chambers of the plurality of pressure chambers in the first direction.

39. (Original) The ink jet printer head according to claim 36, wherein said at least one common electrode includes a plurality of first electrically conductive portions each of which at least partly overlaps a corresponding one of the pressure chambers, and is elongate in the second direction, and additionally includes at least one second electrically conductive portion which extends in the first direction to connect respective one ends of the first conductive portions.

40. (Original) The ink jet printer head according to claim 36, wherein said each of the individual electrodes includes a straight portion which is connected to the end portion thereof and which extends parallel to a corresponding one of the pressure chambers in the second direction and is aligned with said one pressure chamber.